

## **REMARKS**

Applicant expresses appreciation to the Examiner for consideration of the subject patent application. This amendment is in response to the Office Action mailed May 25, 2006. Claims 5, 6, 13, 14, 16, 17, and 21 were objected to. Claims 1-4, 7, 9-12, 18-20, and 22 were rejected. Claims 8, 18, and 23 have been cancelled.

Applicant also thanks the Examiner Pappas for the previous telephone conversation on August 4, 2006 to discuss proposed claim amendments.

### **Claim Rejections - 35 U.S.C. § 102**

Claims 1-4, 7-11, 18-20, and 22 (including independent claims 1, 3, 8, 9, and 19) were rejected under 35 U.S.C. § 102(b) as being anticipated by Bakenov.

With regard to claim 1, the Office Action cited page 26 of Bakenov as “inferring from the control mesh B-spline basis for each control point.” However, a fundamental problem with Bakenov is that Bakenov was not able to infer the basis functions for T-junctions in any form. Bakenov teaches T-junction structure but does not teach a method for inferring basis functions for a T-spline surface.

Bakenov discusses his method for computing the underlying structure of the T-junctions in section 4.3 of his paper and more specifically in pages 56 -59. No where in this section does Bakenov teach or suggest how one would **infer** the basis functions that are needed for a T-junction. Bakenov teaches a procedural method for computing a T-spline which has no similarity to the inferring step of the present invention.

The Office Action has pointed to Bakenov’s discussion describing how prior art B-splines are generated on page 26 of Bakenov. However, this page only teaches how to compute the basis functions for a prior art B-spline. This B-spline computation on page 26 does not infer any basis functions for a T-junction. In fact, the common B-spline computation has been known for over 30 years which illustrates the difficulty in computing a general solution for a T-junction. In addition, Applicant has clarified this operation by claiming the step of “inferring from the control mesh the tensor product B-spline basis functions for each control point **including** T-

**junctions in both parameter directions.”** Inferring basis functions for T-junctions has not been taught or suggested by Bakenov.

For further comparison purposes, pages 10 - 12 of the present application teach the inferring step in detail. A detailed comparison of the method taught by Bakenov on pages 56-59 and the method taught by the present application reveal that they are substantially different. Bakenov’s method clearly does not teach the inferring step and this was Bakenov’s fatal flaw that led to intractable calculations.

Specifically, Bakenov uses a procedural computation of the limited T-spline mesh as he describes from page 54 through 59. Computation steps 3 through 5 become intractable when T-junctions in both directions are used. In addition, Bakenov’s described steps are not elegant or a general solution for T-Spline structure.

The claims have been amended to overcome Bakenov. On page 54 of the Bakenov thesis, he states:

- Two types of s-junction points and t-junction points can not occur in each B-spline mesh of size 5x5 within the T-mesh simultaneously.

These conditions are introduced to make the T-spline scheme simple.

Although they seem to be a little restrictive, such a T-mesh suffices for our application problem merging B-spline surfaces. Bicubic T-spline surfaces over a more general T-mesh are still under investigation.

Not only were these limitations “a little restrictive” but these limitations could not generate a generalized T-mesh. The mathematics taught by Bakenov become intractable when s-junctions and t-junctions occur simultaneously within a local grid.

The method of computing T-Splines described in Bakenov’s thesis is severely limited in scope and applicability. It would only work in the simplest of cases, which is why it did not allow horizontal and vertical T-junctions to properly co-exist. This is a fatally serious restriction, as evidenced by the fact that Dr. Sederberg could not get a paper based on Bakenov’s thesis published by SIGGRAPH.

The formulation or computation method of T-Splines in the present patent application has no such restrictions. The present application presents a way of computing the equation of a T-Spline, regardless of the parameter directions or proximity of the T-junctions. In contrast, the version of T-Splines in Bakenov could compute the equation of a T-Spline only in the extremely simple case when there is a T-junction in a single parameter direction (see page 40 of Bakenov). Moreover, this equation on page 40 does not teach or suggest how to infer the blending functions from the control mesh, which is why it was impossible to extend the equation to more general cases.

In a telephone conference with Examiner Pappas on August 4, 2006, the Examiner asked why the bullet point number three on page 54 was worded to state that there are two types of s-junctions and t-junctions. Dr. Sederberg, Bakenov's thesis advisor, is responsible for most of the concepts in Bakenov's thesis and is likewise the inventor in the current T-Splines patent application. He has stated that the statement may be more accurately stated like this: "Two types of **points**, specifically s-junction points and t-junction points, can not occur in each B-spline mesh of size 5x5 within the T-mesh simultaneously." This clarifies the statement to match with the rest of section 4.3 and overall mathematics presented by Bakenov.

The present claims have been amended to distinguish the claims over these limitations of Bakenov as described in Bakenov's thesis paper. The arguments above also apply to and overcome the obviousness arguments under 35 U.S.C. 103(c).

Claim 23 has been cancelled to help in focusing the issues for consideration. However, Applicant believes the subject matter of cancelled claim 23 is properly supported by page 12 of the specification as long as the mathematical language is correctly understood, and Applicant reserves the right to reintroduce such subject matter.

## CONCLUSION

In light of the above, Applicant respectfully submits that pending claims 1-7, 9, 11-17, and 19-22 are now in condition for allowance. Therefore, Applicant requests that the rejections and objections be withdrawn, and that the claims be allowed and passed to issue. If any impediment to the allowance of these claims remains after entry of this Amendment, the

Examiner is strongly encouraged to call Steve M. Perry at (801) 566-6633 so that such matters may be resolved as expeditiously as possible.

The Commissioner is hereby authorized to charge any additional fee or to credit any overpayment in connection with this Amendment to Deposit Account No. 20-0100.

DATED this 25<sup>th</sup> day of August, 2006.

Respectfully submitted,

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